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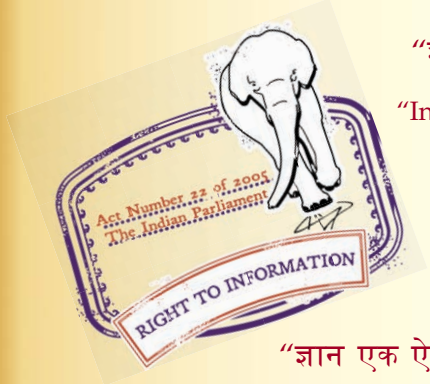

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IS : 8152 - 1976

Indian Standard

METHOD OF MEASUREMENT OF SPEED FLUCTUATIONS IN SOUND RECORDING AND REPRODUCING EQUIPMENT

UDC 681·84 : 534·851·7·032

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

November 1976

AMENDMENT NO. 1 APRIL 1981

TO

IS:8152-1976 METHOD OF MEASUREMENT OF SPEED FLUCTUATIONS IN SOUND RECORDING AND REPRODUCING EQUIPMENT

Alterations

(*Page 3, clause 2.0, line 2*) - Substitute 'IS:1885 (Part XLVIII/Sec 1)-1978†and IS:1885(Part XLVIII/Sec 2)-1978‡' *for* 'IS:1885(Part III/Sec 3)-1967†'.

(*Page 3, foot-note with* '†' *mark*) - Substitute the following for the existing foot-note:

'†Electrotechnical vocabulary : Part XLVIII Recording, Sec 1 Tape recording.

‡Electrotechnical vocabulary : Part XLVIII Recording, Sec 2 Disk recording.'

(LTDC 23)

Reprography Unit, ISI, New Delhi, India

Indian Standard

METHOD OF MEASUREMENT OF SPEED FLUCTUATIONS IN SOUND RECORDING AND REPRODUCING EQUIPMENT

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Indian Standard

METHOD OF MEASUREMENT OF SPEED FLUCTUATIONS IN SOUND RECORDING AND REPRODUCING EQUIPMENT

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 17 July 1976, after the draft finalized by the Acoustics Sectional Committee had been approved by the Electronics and Telecommunications Division Council.

0.2 The object of this standard is to provide method of measurement of speed fluctuations in sound recording and reproducing equipment, using the weighted peak technique.

0.3 While preparing this standard, assistance has been derived from IEC Publication 386-1972 ' Method of measurement of speed fluctuations in sound recording and reproducing equipment ' issued by the International Electrotechnical Commission.

0.4 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard deals with method of measurement (using the weighted peak technique) of speed fluctuations in sound recording and reproducing equipment.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following terms and definitions and those given in IS : 1885 (Part III/Sec 3)-1967† shall apply.

2.1 Pitch Variation — A spurious frequency modulation introduced into a reproduced signal by a variation of the recording medium speed during recording or reproducing. There are two types of pitch variations, namely, flutter and wow.

*Rules for rounding off numerical values (*revised*)

†Electrotechnical vocabulary: Part III Acoustics, Sec 3 Sound recording and reproduction.

2.1.1 *Flutter* — A frequency modulation generally greater than 10 Hz.

2.1.2 *Wow* — A frequency modulation generally between 0·1 c/s and 10 Hz.

3. MEASURING EQUIPMENT

3.1 The measuring equipment shall have the characteristics specified in **3.1.1** and **3.1.2**.

3.1.1 *Response Curve* — The response curve shall be as specified in Table 1 and Fig. 1.

NOTE — An unweighted response curve, flat at least between 0·1 Hz and 200 Hz provides useful additional information about the source of wow and flutter (*see* Fig. 1). Tolerances and dynamic characteristics are not specified for the unweighted response curve.

TABLE 1 WEIGHTING FACTORS

FREQUENCY	RESPONSE	TOLERANCES	
Hz	dB		
0·1	− 48·0	From 0·1 Hz to 0·2 Hz	+ 10 dB, − 4 dB
0·2	− 30·6		
0·315	− 19·7	From 0·315 Hz to 0·5 Hz	± 4 dB
0·4	− 15·0		
0·63	− 8·4		
0 8	− 6 0		
1	− 4·2	From 0·5 Hz to < 4 Hz	± 2 dB
1·6	− 1·8		
2	− 0·9		
4	0	at 4 Hz	± 0 dB
6·3	− 0·9		
10	− 2·1		
20	− 5·9	From > 4 Hz to 50 Hz	± 2 dB
40	− 10·4		
63	− 14·2		
100	− 17·3	From 50 Hz to 200 Hz	± 4 dB
200	− 23·0		

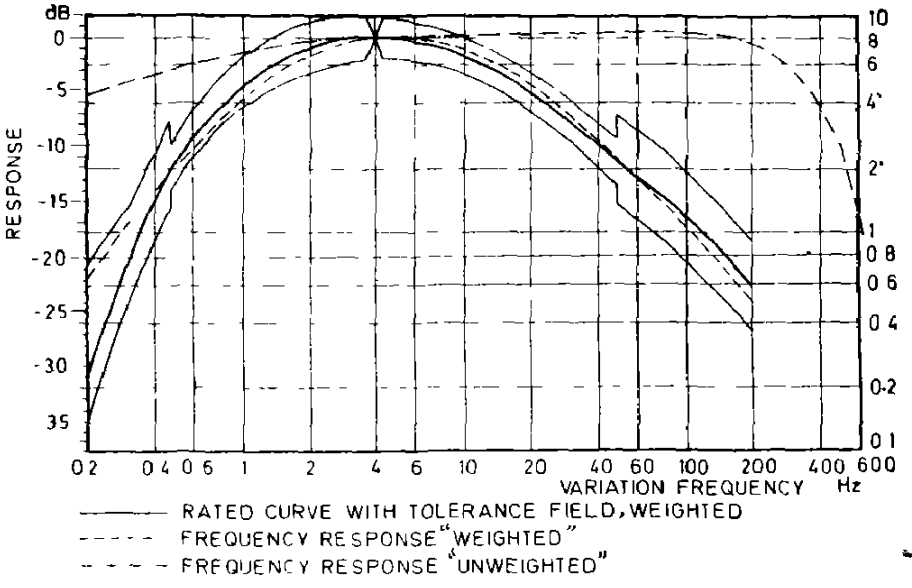


FIG. 1 RESPONSE CURVE

3.1.2 *Dynamic Characteristics*

3.1.2.1 For short unidirectional deviations of the frequency of measurement (rectangular pulses of a duration *A*, *see* Fig. 2) with a repetition rate of 1 Hz, the meter shall indicate the percentage *B* of the reading obtained with a sinusoidal frequency-modulation of 4 Hz having a peak-to-peak deviation equal to the frequency swing of the pulse, that is:

$$\Delta f \text{ pulse} = 2\,\Delta f_{\text{sin max}} \text{ (see Fig. 2)}.$$

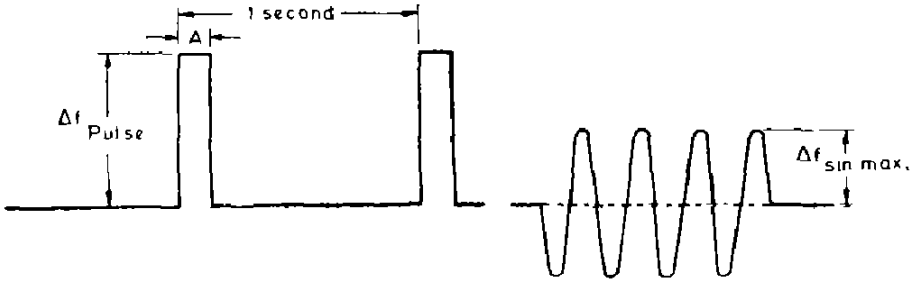
3.1.2.2 The return time of the meter shall be such that, when applying pulses of 100 ms duration with a repetition rate of 1 Hz, the meter shall indicate between 36 percent and 44 percent of the full scale deflection.

3.1.2.3 The dynamic characteristic refers to the complete measuring equipment including weighting network.

3.2 Indication of Instrument

3.2.1 The instrument shall read positive as well as negative deviations as would be obtained, for example by using a voltage doubler.

3.2.2 Though the meter measures peak-to-peak values, the reading shall indicate the wow in percentage of the figure corresponding to one half the peak-to-peak value.



PULSE LENGTH A (ms)	10	30	60	100
INDICATION B (%)	21 ± 3	62 ± 6	90 ± 6	100 ± 4

FIG. 2 DYNAMIC CHARACTERISTICS

3.2.3 Because of the finite return time, it is impossible to avoid variations in the reading with frequency variations of very low frequency. In this case, only the maximum value should be read.

3.3 Additional requirements for measuring equipment are given in Appendix A.

4. MEASUREMENT

4.0 General — In sound recording, it is impossible to obtain completely constant speed of the recording medium because of the limited precision of the mechanical drive. It is impossible to avoid short-term variations (wow and flutter) and there is also often a difference between the average speed at the beginning and at the end of the recording (drift).

For a constant frequency, f, the wavelength λ varies in recording proportionately to the transport speed v according to the equation $\lambda = v/f$. When reproduced with a perfect drive (v = constant), the frequency which was so recorded will show a corresponding frequency modulation. In practice, however, the reproducing system adds its own speed variations, and the consequent frequency modulation adds vectorially to that from the recording. The transport speed variations are best measured by recording a test frequency and then measuring the frequency variations in the subsequent reproduction.

4.1 Wow and Flutter (Short-Term Variations)

4.1.1 When no recording or reproducing machine is available with speed variations much smaller than those of the machine under test, recording and reproduction is usually done on the machine under test. Therefore, a vectorial addition of the two identical variations (one from recording system and other from reproducing system) occurs, and the resulting variations depend upon the phase relation between the two components. In extreme cases, the result is very nearly arithmetic addition.

4.1.2 Since the ear's sensitivity to frequency variations depends on the variation frequency, the measurements are performed with a weighting filter which approximates the characteristics of the ear.

4.1.3 A satisfactory approximation is possible only at the relatively low variation frequencies. At frequencies above approximately 100 Hz, the disturbing effect depends mostly on the frequency and the level of the recorded tones. This disturbance can be significant under certain conditions. In order to obtain readings that are at least comparable, the weighting curve is defined up to 200 Hz. If, in special cases, large variations appear at higher frequencies (for example, the longitudinal tape vibrations), special measuring procedures are necessary.

4.1.4 The fact that the frequency variations are normally non-sinusoidal makes it necessary also to specify the properties of the rectifier circuit and the indicating instrument.

NOTE — In certain cases the rms value of the frequency variation is measured. Since different weighting curves, or none at all, are sometimes used, the results cannot be compared directly.

4.1.5 A method giving the peak value shall be used for the measurement of wow and flutter in sound recording/reproducing equipment.

4.1.6 The measurements shall be made at a frequency of 3 150 Hz.

4.1.7 The measurements shall be made on one element only of the system at a time (either the recorder or the reproducer but not on both) under such conditions that the wow and flutter in the remaining parts of the system is negligible.

NOTE — In the case of a reproducer a standard pre-recorded disk, tape or film will be required.

4.1.8 When this condition cannot be fulfilled, a recorder/reproducer may be measured by recording a 3 150 Hz test frequency and reproducing this recording several times, measuring in each case the total wow and flutter and forming the arithmetic average value of these measurements.

4.1.8.1 Wow and flutter shall not be measured while simultaneously recording and reproducing.

4.1.9 The measuring conditions shall always be stated, namely:

" Reproducer only, recorder only or complete recording/reproducing system ".

4.2 Drift (Long-Term Deviations)

4.2.1 This measurement is of particular importance when a non-synchronous (for example, friction) drive is used, as for example with tapes without perforations. Tapes are often edited after recording, so that the location of a given section of the tape within the tape spool is changed. When drift occurs, sections of tape which have been recorded with slightly different speeds may be edited together. In this case, a sudden change in pitch will occur in reproduction, which can be especially disturbing in musical recording.

4.2.2 In order to measure the drift, a test tone may be recorded for, say 30 seconds, at the beginning of a full reel of tape of the maximum size which can be accommodated by the machine under test. The take-up reel containing the 30 seconds recording can then be transferred on to the supply turntable whilst the reel with the remainder of the tape is transferred to the take-up turntable.

4.2.2.1 If there is drift, reproduction under these conditions results in the frequency changing from the original recorded frequency. The relative frequency difference is called ' drift '.

4.2.3 In disk and film recording, test records and films of sufficient accuracy are available, so that the drift can be measured directly.

4.2.4 The frequency variations are normally measured by means of a frequency discriminator. If the coupling network following the discriminator does not pass dc, this method cannot be used for drift measurement.

4.2.4.1 In this case, the drift may be measured by counting the beats between the reproduced frequency and the frequency from the generator which was used in recording. When testing disk equipment, the frequency obtained from the inner grooves is compared with the frequency from a generator which has been adjusted to the frequency obtained from the outer grooves.

4.2.4.2 One variation of this method of drift measurement which may be used with tape machines is to record the line frequency, and after exchange of tape spools, compare the reproduced frequency with the line frequency. This has the advantage in machines driven from the line that the errors due to variations of line frequency are cancelled out, provided that the line frequency has remained constant throughout the test.

4.3 Absolute Speed

4.3.1 When a non-slip drive is used, it is possible to measure the absolute speed of the medium by reproducing a recording of the exact test frequency and comparing the reproduced frequency with a standard frequency of 3 150 Hz. It does not seem reasonable to demand the necessary frequency, accuracy and stability of the frequency variation (drift) meter itself.

NOTE — The exact measurement of the speed of a non-perforated tape is very difficult. The use of a test tape for such a speed measurement presents a problem because the reproducing speed depends, on the one hand, on the elastic properties of the particular tape, due to the differing tape tensions, and on the other hand, on the tape surface properties, due to the complicated rolling process between the capstan and the pressure roller.

APPENDIX A

(*Clause* 3.3)

ADDITIONAL REQUIREMENTS FOR MEASURING EQUIPMENT

A-1. ADDITIONAL REQUIREMENTS

A-1.1 The measuring equipment should operate within the limits mentioned in **A-1.2** to **A-1.6** for a variation of test frequency of ± 5 percent.

A-1.2 Using the least sensitive range, the indication of frequency between 0·8 Hz and 20 Hz should be linear up to full scale.

NOTE — *It may be desirable to have provision for overload conditions* which are greater than the normal full-scale value.

A-1.3 Under steady-state conditions, the error of indication should not exceed ± 10 percent of the normal full-scale value. This error should not exceed ± 15 percent for any of the conditions given below:

a) Input voltage deviation of ± 6 dB during the measurement.

b) When a 30 percent rectangular 4 Hz amplitude modulation is superimposed on an input signal which is arbitrarily frequency modulated so that the meter reads 0·15 percent in the absence of the amplitude modulation.

c) When frequencies of up to 180 Hz (for example, hum) are contributing up to 20 percent rms of the total input voltage.

d) Line voltage deviations of ± 10 percent.

e) Room temperature variations of between 15 and 35°C (after the equipment has been operating for at least 15 minutes).

f) External magnetic field of 4 A/m.

A-1.4 The required input voltage shall not exceed 100 mV. An indication of the correct level is desirable.

A-1.5 The input impedance should not be less than 300 K Ω at 3 150 Hz.

A-1.6 Provisions for connecting external filters or other analyzing equipment, for example an oscillograph, are desirable. Approximately 1 V output should be provided for all full-scale readings.

INDIAN STANDARDS

ON

RECORDING

IS:

1885 (Part III/Sec 3)-1967 Electrotechnical vocabulary: Part III Acoustics, Section 3 Sound recording and reproduction

2032 (Part XII)-1969 Graphical symbols used in electrotechnology: Part XII Electro-acoustic transducers and recording and reproduction systems

3956-1967 Dimensions of spools for magnetic tapes for sound recording and reproduction

4377-1967 General requirements for magnetic tapes for sound recording and reproduction

4479-1967 Methods of measurements on magnetic tapes for sound recording and reproduction

4480 (Part I)-1967 Magnetic tapes for sound recording and reproduction: Part I Domestic grade

4480 (Part II)-1974 Magnetic tapes for sound recording and reproduction: Part II Professional type

6370-1971 Tape cassettes for domestic use

6391-1971 Magnetic and ceramic phonograph pick-ups

7068-1973 6·25-mm calibration tape

7594 (Part II)-1975 Magnetic sound tape recording and reproducing equipment (cassette): Part II Domestic type

8152-1976 Method of measurement of speed fluctuations in sound recording and reproducing equipment

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